



Are local governments maximizing land revenue? Evidence from China[☆]



Yuan Wang^{a,*}, Eddie Chi-man Hui^b

^a School of Economics, Faculty of Economics and Management, East China Normal University, 500 Dongchuan Road, Shanghai 200241, China

^b Department of Building and Real Estate, The Hong Kong Polytechnic University, Hung Hom, Hong Kong, China

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ABSTRACT

This paper examines how political considerations affect local officials' revenue maximization behaviors in the context of urban land conveyance in China. Particularly, we analyze government intervention based on local officials' choice of two land auction types, namely, "English auction" and "two-stage auction". The latter presumably serves as a tool of government intervention. We aim to address the research question: "Are local governments maximizing land revenue?" The major findings are threefold. First, for cities with higher housing prices, two-stage auctions are adopted more frequently than English auctions. In addition, land parcels in these "hot" cities adopt two-stage auctions more frequently during sensitive political events, suggesting that local officials respond positively to the real estate regulation policy from central government. Second, when city leaders are more incentivized to promote economic performance, they respond less positively to rises in housing prices. Third, such interventionist behavior results in a significantly depressed land price and housing price. Despite its intention of improving public welfare, this interventionism can susceptiblely cause problems of misallocation and corruption.

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1. Introduction

Previous studies on political economics show that fiscal decentralization in developing countries often has a positive impact on economic growth (Jin, Qian, & Weingast, 2005; Qian & Weingast, 1997). A typical strand of those studies has recognized that fiscal incentives are the key to understanding China's economic miracle in the post-Mao era (Xu, 2011). In the context of China, tax-sharing reforms in 1994 and 2002 divert more fiscal revenue from the local to central government, and in return local governments are entitled to enjoy revenue from urban land leasehold. From 1999 to 2013, the ratio of land conveyance fee (which is classified as extra-budgetary revenue) to the local budgetary revenue has risen from 9% to 60% (See Fig. 1.). As a result, literatures find a strong incentive among local officials to promote the real estate sector so as to maximize land revenue (Han & Kung, 2015). Such phenomenon is widely defined by the literature and news reports as "land finance" (e.g. Fu, 2015; Wu, Feng, & Li, 2015; Pan, Huang, & Chiang, 2015; Wu, Li, & Yan, 2015). Moreover, some studies argue that the increasing dependence of "land finance" is a driving force of China's recent soaring housing prices (e.g. Pan et al., 2015). This paper attempts to uncover a "yet-to-know" mechanism in local officials' land conveyance behaviors in China. In view of the political considerations

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* Corresponding author.

E-mail addresses: ywang@jxx.ecnu.edu.cn (Y. Wang), bscmhui@polyu.edu.hk (E.C. Hui).

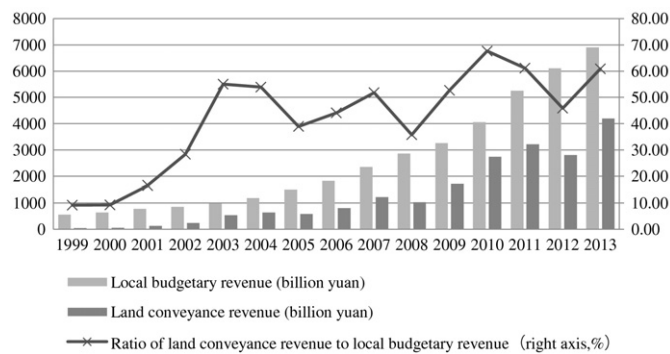


Fig. 1. Land conveyance revenue and local budgetary revenue: 1999–2013.

of local governments, we hypothesize that apart from maximizing local revenue, local officials will respond to the real estate regulation requirement, both from the public and the central government. This means in land conveyance, they will strike a balance in their decision between revenue maximization and price regulation.

We exploit two variations to identify that mechanism. Variations in housing prices across cities generate the first difference. During 2003–2013, housing prices had risen rapidly in China with the annual growth rate reaching 10% on average. Housing prices have been skyrocketing in some major cities. For example, three first-tier cities, *Beijing*, *Shanghai* and *Guangzhou*, had seen an annual growth rate of 14%–16% over the same period. This has given rise to grave concern over the existence of bubbles and housing affordability among residents (Ren, Cong, & Yuan, 2012). Consequently, taming the soaring housing prices has become one of Chinese government's most urgent political tasks since 2003 (Hui & Wang, 2014). A series of regulatory policies has been issued by the central government, of which land market regulations were much emphasized. Based on the prefecture-level panel data, we will investigate if higher housing prices would significantly increase the likelihood of government intervention in land conveyance. We hypothesize that cities with a higher housing price and growth rate face a greater pressure from both residents and central government, thus may result in more intervention in land conveyance.

The second difference is provided by variations in local officials' career concerns. Since its post-reform era, China has adopted a GDP-centered cadre evaluation criterion and the likelihood of cadre promotion is demonstrated to be strongly related to local economic performance (Li & Zhou, 2005). In this sense, "land finance" is essentially linked to city leader's promotion incentive in that land revenue is crucial to promote local economic growth (Cai, 2011; Kung & Chen, 2013). Previous studies on political cycles further point out that the local official's incentive structure varies in different stages of career (Guo, 2009). Generally, leaders with shorter tenures are more incentivized to promote economic performance due to their larger probability to get promoted (Zhou, Zhao, & Li, 2013). In such a context, we hypothesize that local officials with shorter years in office tend to value more on land revenue maximization (in promoting economic growth) than those with longer tenures.

We further estimate the price distortions caused by government intervention in land conveyance. The dataset used for estimation comprises comprehensive parcel-level transaction records covering almost all cities during 1998–2012. We can exploit the parcel-level dataset to correct for the potential selection bias issue using the Propensity Score Matching and Treatment effect model. We also examine the effect of land conveyance intervention on housing prices.

By analyzing an important public policy issue—land conveyance in China—this paper provides a new understanding of local officials' incentives. We show that the misaligned incentives of governments can lead to direct land intervention and a distorted land price. This paper also contributes to the existing literature on real estate regulation by analyzing a new, distinctive intervention regime. Traditionally, land use regulation usually takes the form of urban planning, such as urban growth boundaries, minimum lot sizes, density restrictions and so on. Many scholars show that those regulations have an indirect effect on real estate prices by changing the elasticity of house supply (Gyourko & Molloy, 2014). We look into a rather different yet important form of regulatory regimes in the context of land supply monopolization, which directly distorts land prices. In order to measure the extent of such a regulation, this paper exploits local governments' choice between two different land auction types—English auction (*Paimai*, in Chinese) vs two-stage auction (*Guapai*, in Chinese). While the former type has an open bidding process, the latter typically involves an under-the-table negotiation between local government and land buyers. Presumably, the two-stage auction serves as a tool of manipulating the land auction process (Xu, Yeh, & Wu, 2009). Therefore, we can define the adoption of two-stage auction as an indicator of government intervention.

The remainder of the paper is organized as follows. The next section provides a brief institutional background of China's land market. Section 3 presents the data sources and empirical specifications. The next two sections identify the causes and effects of land conveyance intervention. Section 4 examines the determinants of the adoption of two-stage auction using both the prefecture-level panel data and parcel-level data. Section 6 estimates the effects of two-stage auction adoption on individual parcel prices and local housing prices, employing both a parcel-level and the prefecture-level dataset. Concluding remarks are in Section 6.

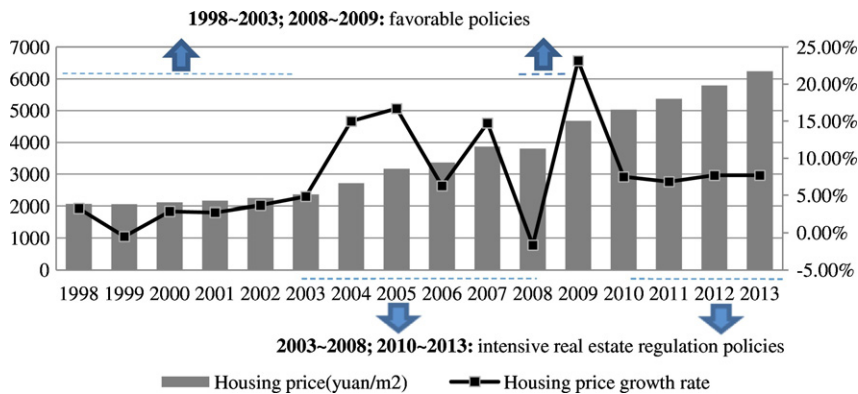


Fig. 2. Housing price and national real estate policies: 1998–2013.

2. Background

This section provides the background and logic framework of land market intervention of Chinese local governments. The first two parts introduce the background of China's real estate regulation and land institution. Finally we discuss the incentive of governments to regulate real estate market.

2.1. Real estate regulation in China

Since China fully reinstated the housing market in 1998, real estate industry has become a main contributor to national economic development over the years. Housing prices and land prices have been skyrocketing especially since the establishment of land auction system in the 2000s (See Figs. 1 and 2). At the same time, housing has become less affordable for residents. Fig. 3 shows that the housing price-to-income ratio was higher than 7 in most years before the financial crisis, higher than the calculated reasonable upper bound by Lv (2010): 4.38–6.78. This generates a general concern for social welfare. Consequently, taming the soaring real estate prices has become one of Chinese government's most urgent political tasks since the real estate boom in 2003 (Hui & Wang, 2014). As land prices are closely associated with housing prices, land prices has become a main regulation target. A series of regulation policies were issued during the last decade, with late 2008 and 2009 being the only exceptions¹ (See Fig. 2). Among those policies, central government especially requires local governments to “take advantage of the land auction system to regulate land prices”.²

2.2. Land market intervention in China

In most counties including United States and China, land use is controlled by local governments. A growing body of literature has discussed the impact of regulations on real estate markets (see a comprehensive literature review by Gyourko and Molloy (2014)). The main target of these regulations is to control land use. On the incentives of such regulations, one notable argument is the “homevoter hypothesis” raised by Hamilton (1978), positing that municipalities respond to the requirement of homeowners and restrict land supply to maintain high house prices in the locality. Kahn (2011) and Hilber and Robert-Nicoud (2013) present indirect empirical evidences of this hypothesis using data from United States. In contrast with the bottom-up power structure in a democratic economy where promotion of local leaders are decided by homevoters, promotion of local leaders in China is decided by their upper-level governments (Yu, Zhou, & Zhu, 2016). Under this regime, in responding to the real estate regulation policy from the central government, price regulation has become one of the main targets of land intervention, which differs from practices from the developed economies.

On the effects of land use regulation, there are plenty of empirical analyses of housing market effects. Many show that these regulations depress house supply and lead to higher land and housing prices (such as Huang & Tang, 2012; Kok, Monkkonen, & Quigley, 2014). There is also evidence that regulations depress land prices as shown in Ihlanfeldt (2007). He interprets this as the evidence of land use restriction reducing the development potential.

Different from most developed countries, urban land is owned by the State in China, and other than land use, land allocations are controlled by local governments. Urban land leasehold conveyance was made official by the Constitution in 1988. Land users

¹ Due to the global financial crisis, China's real estate market endured a sharp slowdown in late 2008 (see Fig. 2). In response, the central government suspended the regulation policies during late 2008 and early 2009. Fiscal stimulus and loose monetary policy led to a new round of real estate boom in 2009, making central government revert to the regulation policies in late 2009.

² See in the official document from Ministry of National Land Resources #204 in 2010, “A Notice on Strictly Implementation of the Real Estate Land Control to Promote a Well-functioned Land Market”.

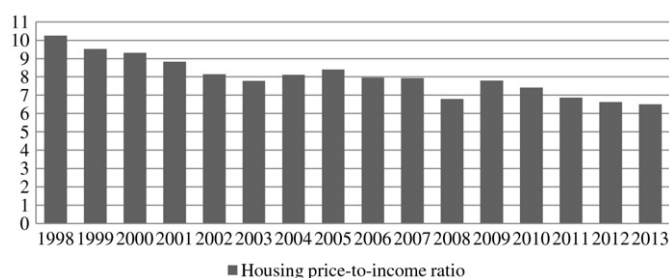


Fig. 3. Housing price-to-income ratio: 1998–2013.

can obtain land use right with a lease of 30–70 years for a specific use from the land bureaus of local governments. The land allocation system has been changing to find a balance between market and government control. In the 1980s, the system was developed based on the planned economy. Most land was allocated to state-owned enterprises for free (*huabo* in Chinese) or transferred through an under-the-table process (*xieyi* in Chinese), thus local officials possessed considerable discretions to determine land users and land prices. With some critical reforms in the 2000s, land allocation started its transition from a planned process to a market-oriented one. China's current land allocation system is based on 2002's #11 order from Ministry of National Land Resources. With local governments still monopolizing the supply, all commercial/residential land parcels are required to be bid openly and fairly. Since then, China has gradually built a price mechanism for urban land leasehold.

Owing to the booming real estate sector since the housing system reform in 1998, China's revenue from land conveyance has been rising considerably. Standing at 4200 billion yuan in 2013, land revenue was 82 times its size in 1999. To the extent that land revenue plays an increasingly important role in local fiscal revenue, local official is perceived as a revenue-maximized land developer (Lichtenberg & Ding, 2009). However, government intervention still widely exists, taking the form of manipulation in the land bidding process. One strand of literature argues that government intervenes in land allocation to plan for economic growth, that is, local officials attract particular land users for the good of local economic development by controlling land supply (Tian & Ma, 2009). Some researchers distinguish between incentives in industrial and commercial/residential land leasing and note that local officials underprice the industrial parcels to attract investment on the one hand, and rely on market mechanism to maximize the revenue in commercial/residential land conveyance on the other (Tao, Su, Liu, & Cao, 2010). Others contend the manipulation as evidence of corruption (Cai, Henderson, & Zhang, 2013). This paper proposes another possible cause of local officials' intervention in commercial/residential land conveyance—the nation-wide real estate boom and macro regulation since 2003.³

Barlow (1993) examines the practices to control land prices in high-growth housing market areas of Britain, France and Sweden, which largely rely on the land-use planning system. By contrast, Chinese local governments have direct control over the land market. Yet in a market-oriented land conveyance system, local officials must design an appropriate intervention approach without violating the existing auction system. Current land auction system provides three choices for land conveyance: *English auction* (*Paimai*), *two-stage auction* (*Guapai*) and *tender* (*Zhaobiao*). *Tender* is typically applied in projects with special requirements such as local landmarks and public buildings,⁴ hence we ignore this type in our following analysis. *English auction* is a standard ascending bid auction with an open competing process. An *English auction* is required to have at least three qualified bidders, if not, the auction is considered to fail (called *liupai* in Chinese).⁵ *Two-stage auction* adds an under-the-table stage before *English auction*. In the first stage, bidders sequentially bid for the for-sale parcel and land bureau officials accordingly update the bids and make the updated information open to the public. If more than one bidder wants to raise bid at the end of the first stage, the process switches into an *English auction*. Otherwise, if there is only one remaining bidder, he/she can successfully acquire the parcel at the bid price.

We focus on the differences between *English auction* and *two-stage auction* in the extent to which government intervention can be implemented. Cai et al. (2013) compare the process of the two types within a framework of auction theory. They apply a sequential game model to illustrate that the price signal from the designated developer in the first stage of *two-stage auction* deters competitors' entry into the game, which they believe is how government intervention can be facilitated. Apart from this possible mechanism, we believe that the qualification settings for land users from local governments are more critical for understanding intervention in land conveyance. Upon engaging in land auction, potential bidders must meet the "qualifications" written in the government announcement of a certain parcel. In other words, local officials can exploit those qualifications to screen out other potential bidders, in order to ensure a trusted land user to win the auction at a predetermined land price. However, given the requirement of at least three qualified bidders in *English auction*, it is difficult to appoint a qualified land user by setting

³ There are generally two types of policy instruments for local officials to tame the rising price, increasing real estate supply and directly regulating price. Although the former is more efficient, China's real estate regulation usually takes the form of direct intervention and the corresponding policies are notoriously inconsistent and short-run. The possible reasons are twofold: first, China's land supply is almost inelastic because of the strict land quota system. Second, curbing house/land prices in the long run is not consistent with local officials' career incentives, making such an interventionism a product of the misaligned incentives of Chinese governments.

⁴ Only 1.68% of land sales uses *tender* during 1999–2010 according to the *China Land and Resources Statistical Yearbook*.

⁵ See 2002's #11 order from Ministry of National Land Resources.

qualification restrictions for other potential bidders. This requirement does not apply to *two-stage auction*, where the land parcel can successfully be sold even with only one bidder.

To sum up, *two-stage auction* can serve as a tool of manipulating land auction process (Xu et al., 2009), while *English auction* is generally market-oriented. As local authorities have considerable discretion in the choice between those two types in land conveyance, we can regard the adoption of *two-stage auction* as an indicator for government intervention. Considering the flexibility of *two-stage auction* in manipulating auction outcome, this paper conjectures that a higher housing prices can cause more political pressure for local officials, resulting in more *two-stage auction* adoptions. Accordingly, we can propose the following hypothesis:

Hypothesis 1. More *two-stage auctions* are adopted when housing prices become higher.

2.3. Political incentives on land market in China

We continue to discuss how local officials are incentivized to regulate real estate market. One predominant explanation of China's post-reform economic miracle emphasizes the role of political incentives of local officials (Li & Zhou, 2005). Since the 1980s, fiscal decentralization has empowered Chinese local officials with large discretion in the way they operate local development (Jin et al., 2005; Qian & Weingast, 1997), while in a multidivisional-form (M-form) structure local officials are evaluated by the upper-level governments on the basis of their economic performance (Maskin, Qian, & Xu, 2000). The political centralization, together with fiscal decentralization, generates considerable incentives for local officials to promote economic growth (see a comprehensive literature review by Xu (2011)).

In such a system, rising housing prices and land revenue maximization is consistent with the political incentive as well as the fiscal incentive of local officials, which is widely accepted as the “land finance” hypothesis (*tudicaizheng*, in Chinese).⁶ On the one hand, land revenue has become one of the most important sources of local revenue (Han & Kung, 2015). Two sets of tax reform, in 1994 and 2002, reduced the tax share of local governments to a large extent. In return, the central government encouraged local officials to solve the financial problem by managing the local land market, where local governments were assigned full discretion over revenue from land leasehold conveyance. Since then, local finance has relied on land revenue to a large extent (see Fig. 1). In 2013, for example, the land conveyance fee accounts for more than 60% of the local budgetary revenue. On the other hand, as what Kung and Chen (2013) find, land revenue is positively and significantly correlated to the promotion likelihood of the city leader. They propose a possible channel, called *signaling*. More specifically, land revenue maximization enables the investment in large-scale public projects to signal the political achievements of city leaders. A more general mechanism is that, as land revenue has always been a main source of government investment (Peterson, 2006; Ding, Niu, & Lichtenberg, 2014) and jurisdictions across China have been investment-led over the past two decades (Du, Fang, & Jin, 2014), land revenue is crucial for local economic growth—a major criterion for cadre promotion (Cai, 2011).

Since China's real estate market boom in 2003, the skyrocketing housing prices as well as land prices have become a major social concern and thus an urgent political concern for the central government (Hui & Wang, 2014). Therefore, how to create incentives for local officials to make effort in taming real estate prices has been an urgent task for the central government. Under the Chinese-style political centralization and economic decentralization, one frequently-used measure is to use the accountability system to directly put pressure on local officials.

Nation #8 issued by the State Council in 2005 first proposes the establishment of an accountability system in regulating real estate markets. Since then, several official documents had reiterated that local officials should take the responsibility for stabilizing real estate markets (including house and land markets).⁷ However, in practice, it is difficult to determine whether local officials should be responsible for rising market prices. This might be the main reason that we have not seen any penalties resulting from excessive rises in real estate prices. Rather, it takes the form of formal interviews from the cadres of a higher rank or from the central government.⁸

In view of this, taking local officials' personal incentives into consideration leads to a tradeoff: when auctioning land parcels in a booming market, local officials compare the benefit and cost of high auction prices. The benefit of rising land revenue is associated with a larger discretion on fiscal expenditure to signal economic achievement (such as infrastructure construction); while the cost is that the soaring land prices can raise the risk of getting penalized by the central government.

While the cost is almost fixed for all local officials,⁹ the benefit is much higher for those who are more incentivized to get promoted. As the relative benefit from rising land prices is larger for local officials who are more incentivized to get promoted, we

⁶ A growing body of literature on “land finance” emphasizes Chinese local governments' revenue incentives in land conveyance and the effects on economic outcome (such as Tao et al., 2010; Fu, 2015; Wu, Feng, & Li, 2015; Pan et al., 2015; Wu, Li, & Yan, 2015).

⁷ Those documents include, Nation #5 issued by the State Council in Apr. 2010, New Nation #5 issued by the State Council in Feb. 2013, and “on fully implement the real estate regulation and stabilize land market” issued by Ministry of Land and Resources in Dec. 2010.

⁸ See the following relating news reports: “Seven Cities are Penalized by Ministry of Housing and Urban-Rural Development for Excessive Growth in Housing Prices” http://news.xinhuanet.com/house/cz/2013-09-06/c_117253560.htm; “Land Regulation Task Becomes Urgent Prior the Third Plenary Session; Cities Will Get Penalized for Historically High Land Auction Prices” <http://house.china.com.cn/home/view/699485.htm>; “Hangzhou Suspended Two Land Auctions in One Week to Avoid Getting Penalized for the Potentially High Auction Price” http://news.xinhuanet.com/fortune/2013-10/16/c_125544029.htm.

⁹ Compared with the increase of benefit from rising land prices for those who are more incentivized to be promoted, increase of the cost is negligible. Empirical evidence presented by Kung and Chen (2013) verifies this conjecture: they find that in average more land revenue brings local officials a higher probability to get promoted.

predict that they will be less prepared to regulate land price. To empirically examine this argument, we can exploit the variation of city leaders' career incentives over different tenures.

According to Article 106 of the state constitution and Article 26 of the party constitution, the term of office of the party secretaries should be five years and they cannot stay in the same position for more than two terms. Studies on political cycle point out that local leaders tend to strategically manage economic growth at crucial points in time of their career to enhance the promotion likelihood (Guo, 2009). A rational city leader whose goal is to get promoted will gradually accelerate investment in his/her jurisdiction from the start of the tenure to make sure that the local economy performs well during his/her term. Yet at the end of the term, incentives to accelerate investment decrease because the achievement will probably benefit his/her successor instead of himself/herself (Zhou et al., 2013). Li and Zhou (2005), among others, verify that promotion is less likely for Chinese local officials with longer tenures, because "longer tenure without promotion may be a bad signal indicating a lack of ability".

Along this line, we hypothesize that city leaders' goal in land conveyance shifts over the course of their tenures. With more probability to get promoted, city leaders at the start of their current post tend to value more on land revenue maximization to signal the economic achievement. For those with longer tenures, knowing that the promotion probability shrinks, they tend to follow the policies from the central and put more emphases on land market regulation. One concern with the identification is that the differences of land conveyance behaviors across different tenures may arise from reasons that have nothing to do with the career incentives of city leaders. For example, their personal characteristics differences across tenures may affect their decision on land conveyance. In view of this, we can exploit the additional difference—market situation—to better isolate city leaders' career incentives across tenures. If a city leader with a shorter term in office (first difference) intervenes less frequently in land conveyance when housing price goes higher (additional difference), we can say that the effect of career incentives on land conveyance is identified. Given the fact that incentive structure varies across local officials' tenures and two-stage auction as the manipulated land auction type, we have our [Hypothesis 2](#).

Hypothesis 2. When housing prices go higher, city leaders with shorter tenures intervene less frequently in land conveyance, leading to less two-stage auction adoptions.

To sum up, the logic framework of this paper is as follows: first of all, taming the soaring real estate prices has become one of the political tasks of Chinese central government since 2003. Due to its close relation with house price, land price has become the main regulation target. Second, the central government implements an accountability system to incentivize local officials to regulate real estate market. Local officials will compare the benefit and cost of high land prices and determine a suitable auction type. Those who are more incentivized to get promoted can benefit more from rising land prices, thus they tend to less interfere with land auction. Finally, land price regulation can be realized by adopting *Guapai*, i.e. the two-stage auction.

3. Data and empirical model

This paper will analyze the extent to which land conveyance intervention varies with market situation and city leaders' career incentives. Before that, we introduce the data, model, variables and the possible identification issues.

3.1. Data

We focus on commercial and residential land transactions because their land conveyance decisions can be affected by the real estate market.¹⁰ We construct a prefecture-level dataset over the period 2003–2008 to examine local officials' choice of land auction types. We use prefecture-level data because it is the municipal government that makes land supply decisions. The timespan of study is from 2003 to 2008, since data on the prefecture-level land area for two-stage auction and English auction are only publicly available during this period. After 2008, official data no longer differentiate between the two types. During this period, commercial and residential land must be conveyed using tender (*Zhaobiao*), English auction (*Paimai*) or two-stage auction (*Guapai*). Also, it is during this period that China's real estate market became overheated and regulation policies from central government became intense correspondingly. Hence this timespan provides an ideal background to test our hypotheses.

The prefecture-level data mainly comes from official Chinese publications: land transaction data are from *China Land and Resources Statistical Yearbook*, and economic data are from *China City Statistical Yearbook*. Values for GDP, housing prices and land revenue are at 2002's constant level using prefecture-level GDP deflator. To test city leaders' career incentives, we also compile data on the year in office of city Party secretaries from their career histories.¹¹ Data from various sources form a new original dataset including all 286 prefecture-level cities. We exclude city *Lasa* from Tibet because many studies consider its role quite unique as an ethnic minority, making it not comparable to other cities in the policy-making process. Then we have a prefecture-level panel dataset of 285 cities and 6 years (due to missing values in raw data, less than 265 cities are actually included in empirical models). We do not study the under-the-table transaction (*Xieyi*) or tender (*Zhaobiao*), since commercial and residential parcels are not allowed to adopt the former type, while the latter is seldom used.

¹⁰ Commercial lands are also allowed to build residential apartment in China, and the commonly-used housing price index is measured by the average unit price of newly-built residential/commercial property. Accordingly, we use residential/commercial land information to construct the variables.

¹¹ We only study the city Party secretaries and not the city governors because the former ranks higher than the latter in Chinese political hierarchy and has more authority in dealing with regional affairs (Joseph, 2014).

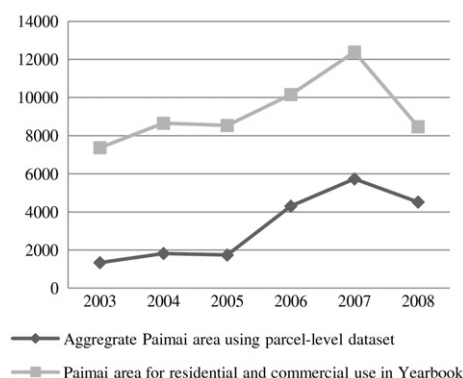


Fig. 4. Aggregate Paimai area in both dataset.

One consideration about the data is that we cannot distinguish the data of commercial and residential parcels from the total *Guapai* and *Paimai* area at the prefecture-level due to the limitation of the original data. Yet this concern can be alleviated because according to the aggregate data, most parcels using the two types are of the commercial or residential use: aggregate data from *China Land and Resources Statistical Yearbook* shows that commercial and residential land transactions account for 87% and 90% of the total land transactions using *Guapai* and *Paimai* respectively during 2003–2007. For the same reason, some studies usually use land transaction information of these types as a proxy for land use pattern (eg. Cai, 2011; Tao et al., 2010). However, the #39 order issued in late 2007 caused a policy shock by further requiring competitive industrial land to be auctioned publicly, leading to a sudden increase of industry lands in aggregate *Guapai* area. In 2008, the proportion of industrial land transactions using *Guapai* in aggregate data reaches 55%. In the proceeding empirical analysis, we will control this policy shock using year dummies and proxies for industrialization. Further robustness test excludes the 2008 data.

We use an additional parcel-level dataset from 1998–2012 to verify the price distortion caused by government intervention. The parcel-level dataset are constructed based on the original parcel data from *Soufun*, a prominent data company in China. The company collects parcel information from the official websites of land bureaus of local governments. This dataset covers almost all cities in China, where 70,050 detailed land transaction records from 208 cities are provided. The records of land parcels using the under-the-table transaction (*Xieyi*) cannot be traced because these data are not open to the public. The transaction time of the available data is from 1998 to 2012, which allows us to test the existence of price distortion over a longer time span. Based on the location information of each parcel, we obtain their coordinates (latitude and longitude) using Geocoding API service provided by Baidu, a popular Chinese internet search engine. Combining the coordinates of municipal government (which usually locates in the city center), we can calculate the distance to the city center for each parcel. We exclude records of industrial land because their prices (which are usually quite low) hardly affect the housing prices. Records of parcels using tender (*Zhaobiao*) are also excluded.

We compare our parcel-level dataset with the prefecture-level data from the Yearbook to detect if the sampling is random. Figs. 4 and 5 show the prefecture-level aggregate area of parcels using two-stage auction (*Guapai*) and English auction (*Paimai*) in both datasets respectively. Although obviously there are missing records in our parcel-level dataset, the year trends are almost the same for both datasets. The adoption of the two land auction types in both datasets is generally similar in Fig. 6, except that the data in 2005 displays somewhat an anomaly. In general, we can consider the sampling in the parcel-level dataset to be random.

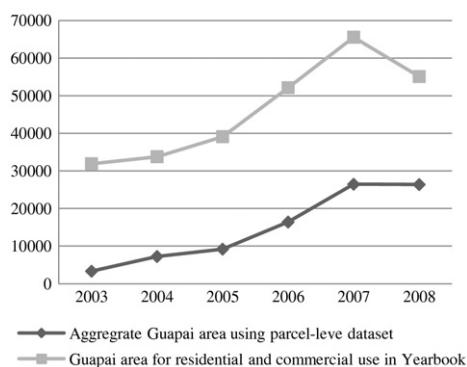


Fig. 5. Aggregate Guapai area in both dataset.

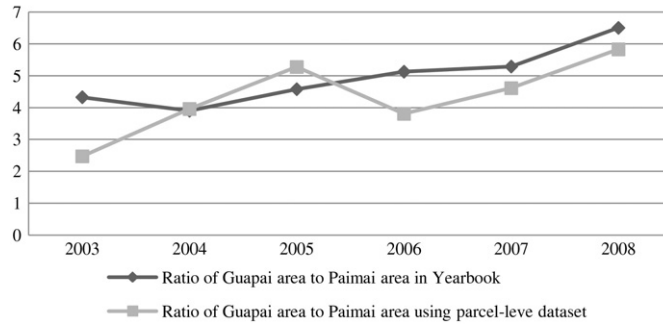


Fig. 6. Ratio of *Guapai* area to *Paimai* area.

3.2. Empirical models

This part specifies two types of models for testing the causes and effects of land conveyance intervention. As discussed earlier, the two-stage auction (*Guapai*) involves government intervention and English auction (*Paimai*) can be considered market-oriented. Hence we use the relative proportion of *Guapai* area to proxy for the extent of government intervention across cities.

When investigating the causes of intervention, we use two variations for identification. One is to take advantage of situations that generate exogenous variation in the necessity of controlling land price. In our context, social welfare considerations and pressure from the central government will arise in cities with higher housing prices, hence we expect those cities are more incentivized to intervene in land conveyance. The second variation is city leaders' career incentives. Due to the GDP-centered promotion criterion, land revenue is found to be positively related to promotion (Kung & Chen, 2013). We can thus predict city leaders with higher promotion possibility are less incentivized to control land price. We take the first mechanism as the baseline and specify the fixed-effect model as follows:

$$Guapai\ ratio_{it} = \alpha + \beta \ln(Housing\ Price_{i,t-1}) + X\gamma + u_i + \delta_t + \varepsilon_{it} \quad (1)$$

where u_i and δ_t capture the city and year fixed effect, and ε_{it} is the error term. $Guapai\ ratio_{it}$ is measured by the share of *Guapai* area in total *Guapai* and *Paimai* area in city i and year t . The key variable, *Housing price*, is measured by the average price of the newly built commercial/residential properties in the city. This measurement is commonly-used in China to evaluate the market situation. It is lagged by one year to alleviate the potential endogeneity issue which we will revisit in the next section. Coefficient β captures the effect of housing prices on government intervention.

X' is a vector of control variables, including two groups of factors.¹² The first group includes factors that may affect incentives in land conveyance such as *Land revenue dependence*, *Corruption cases*, *Illegal land area* and *Government intervention*. *Land revenue dependence* measures the dependence of local finance on land revenue, using ratio of land revenue to local budgetary revenues, which is related to the fiscal incentives of local officials. We use the number of corruption cases per 10,000 government officials (*Corruption cases*) and the area of illegal land transactions (*Illegal land area*) to control the rent-seeking incentives. The former variable is manually collected and calculated from the annual official reports of people's procuratorate in 31 provinces; the latter is from *China Land and Resources Statistical Yearbook*. The ratio of budgetary expenditure to GDP (*Government intervention*) measures governments' intervention in local economy.

The second group controls for general economic characteristics, including *GDP per capita*, *Secondary industry ratio* and *Marketization*. We also include an interaction term of the share of secondary industry output (*Secondary industry ratio*) in GDP and a year (time) dummy to control the policy shock in 2007, which we discussed earlier.

The model further includes the city Party secretary's tenure (*Year in Office*) to test for the impact of city leaders' career incentives. According to literature on political economics, Party secretary makes decisions on important issues in city management (Joseph, 2014). Existing studies contend that Party secretaries with a shorter year in office have a larger possibility to get promoted and those leaders are incentivized to focus more on local GDP than social welfare (Li & Zhou, 2005). Accordingly, *Year in Office*

¹² We also try to control the following variables: (1) Price-to-income ratio is used to measure real estate bubbles; (2) Investment elasticity, which is the ratio of growth rate in real estate investment to that in GDP, is used to measure the dependence of local economy on real estate sector. (3) Growth rate in property sales area is used to control real estate market situation. (4) The ratio of budgetary expenditure to budgetary revenue is used to control local fiscal situation. The effects of variables (1)–(3) are insignificant and major results do not change with or without those variables. Besides, variable (4) has serious collinearity issue with the variable *Government intervention*. Therefore, those control variables are not included in the final results.

Table 1

Descriptive statistics of Prefecture-level data: 2003–2008.

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
<i>Guapai ratio</i>	Share of <i>Guapai</i> area in total <i>Guapai</i> and <i>Paimai</i> area (%)	1678	81.20	22.97	0.00	100.00
<i>Housing price</i>	Average residential/commercial housing price (yuan/m ²)	1534	1712.59	1011.68	153.51	10,042.57
<i>Housing price growth rate</i>	(%)	1079	0.08	0.27	−2.13	2.23
<i>Land revenue dependence</i>	Ratio of land revenue to government budgetary revenue (%)	1414	55.71	44.60	0.13	334.21
<i>Corruption cases</i>	Number of provincial provincial corruption cases per 10,000 government officials	1716	32.18	9.84	6.97	68.76
<i>Illegal land area</i>	Provincial illegal land transactions (10,000,000 m ²)	1716	1.54	1.59	0.02	6.80
<i>Government intervention</i>	Ratio of budgetary expenditure to GDP (%)	1706	11.80	5.85	3.13	100.39
<i>Secondary industry ratio</i>	Share of secondary industry output in GDP (%)	1680	46.85	12.14	8.99	105.77
<i>Marketization</i>	Provincial ratio of real estate firms to property sales area (thousand m ²)	1653	0.12	0.06	0.06	0.58
<i>Year in Office</i>	City Party secretary's total years in office	1715	2.73	1.65	1.00	11.00
<i>GDP per capita</i>	10,000 yuan	1542	1.52	1.72	0.16	22.89
<i>Land supply area</i>	Residential and commercial land supply area (10,000 m ²)	1411	234.88	34.07	0	3330.39

Data source: *Statistical Yearbook of China*, *China City Statistical Yearbook*, *China Land and Resources Statistical Yearbook* and annual official reports of People's Procuratorate in 31 provinces.

Notes:

1. Commercial lands are also permitted to build residential apartment in China, and the commonly-used housing price index is measured by the average unit price of newly-built residential/commercial property. Accordingly, we use residential/commercial land information to construct the land variables.

2. All monetary values are deflated with the base of 2002.

3. Descriptive statistics of the following variables are from 2002–2007 because we will use the lagged terms of them in the regressions to alleviate the potential endogeneity issue: *Housing Price*, *Housing price growth rate*, *GDP per capita*, *Corruption cases*, *Illegal land area*, *Secondary industry ratio*, *Land revenue dependence*, *Land supply area*.

4. All variables use the prefecture-level data except that *Corruption cases*, *Illegal land area* and *Marketization* are from the province-level due to data availability.

can proxy for the career incentives of city leaders and the baseline model is extended as follows:

$$\begin{aligned} \text{Guapai ratio}_{it} = & \alpha + \beta_1 \text{Year in Office}_{it} \cdot \ln(\text{Housing Price}_{i,t-1}) \\ & + \beta_2 \ln(\text{Housing Price}_{i,t-1}) + \beta_3 \text{Year in Office}_{it} + X\gamma + u_i + \delta_t + \varepsilon_{it} \end{aligned} \quad (2)$$

To investigate the potential effects of land intervention on housing prices, we use the following specifications:

$$\ln(\text{Housing Price}_{it}) = \alpha + \phi \ln(\text{Housing Price}_{i,t-1}) + \sum_{j=0}^1 \beta_{t-j} \cdot \text{Guapai ratio}_{i,t-j} + X\gamma + u_i + \delta_t + \varepsilon_{it} \quad (3)$$

We apply a system GMM model developed by Arellano and Bover (1995) to estimate this dynamic panel-data model and alleviate the possible endogeneity issue. With the existence of construction time lag, we consider one period of lag for the independent variables, assuming land intervention may take effect in one year. We also control for *Land supply area* and *GDP per capita* and year and city fixed effect.

All the above specifications use the prefecture-level panel data, and the descriptive statics of variables are displayed in Table 1.

To present more direct evidences of land intervention caused by the pressure from central government, we use parcel-level data and study the choice of land auction types when certain political events make land price regulation an urgent issue. Based on micro data of land transactions, we exploit a Probit model to examine how the choice of land auction type responds to the pressure from central government, specified as Eq. (4). This specification uses the idea of a DDD design (Difference-in-Difference-in-Difference). Dependent variable is the auction type dummy, which equals 1 for *Guapai*, 0 for *Paimai*. Independent variable of interest is an interaction term, which includes the prefecture-level housing price and its growth rate, and a dummy for the political event. The coefficient θ shows how local officials of “hot” cities (that is, cities with higher housing price and faster price growth rate) respond to the political event in land auction. If our story applies, we should expect θ to be positive. The political events we will consider are the Provincial Communist Party Congress, the State Council Housing price regulation policy and the occurrence of land transaction price with new record highs. X' is a vector for control variables, including level terms of the interaction term, parcel characteristics (including *Reserve price* of the parcel, *Land area*, *Floor area ratio*, *Distance to CBD* (proxy for location), and dummies for land use patterns (*Commercial use*, *Mixed use*)), city-level *GDP per capita*, and season, year, city fixed effects.

$$\text{Guapai}_{ijt}^* = \alpha + \theta \cdot \ln(\text{Housing Price})_{jt} * (\text{Growth rate})_{jt} * \text{Policy dummy}_t + X'_{ijt}\gamma + \varepsilon_{ijt} \quad (4)$$

$$\text{Guapai}_{ijt} = \begin{cases} 1 & \text{if } \text{Guapai}_{ijt}^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

To deal with the potential selection bias issues in prefecture-level analysis (which we will specify in the next part), we use the parcel-level data to identify the effect of auction types on land prices. The baseline model is specified as a hedonic price model:

$$\ln \text{Land price}_{ijt} = \alpha + \lambda \cdot \text{Guapai}_{ijt} + X'_{ijt}r + u_j + \delta_t + \varepsilon_{ijt} \quad (5)$$

where *Land price*, the key variable, is the conveyance fee for parcel *i* in city *j*, which is sold in year *t*. *Guapai* is a dummy variable which equals one when the parcel is sold by two-stage auction, zero when it is sold by English auction, therefore λ captures the effect of auction types on auction outcomes. Choice of auction types should be related to parcel characteristics, resulting in a selection bias issue. We control a vector of parcel characteristics to alleviate this concern. The vector X' includes *Land area*, *Floor area ratio*, *Distance to CBD* (proxy for location), and dummies for land use patterns (*Commercial use*, *Mixed use*). We also include the *Reserve price* of the parcel, which is an exogenous valuation of the parcel by the land allocation committee (Cai et al., 2013), to control for other unobserved parcel attributes. Season, year and city dummies are also included.

Table 2 displays the descriptive statics for the parcel-level data.

3.3. Endogeneity issues

This part discusses the endogeneity issues and identification strategies for both the prefecture-level and parcel-level estimation.

3.3.1. Endogeneity issues in prefecture-level estimation

One may concern with the possible reversal causality relationship between housing price and the adoption of two-stage auction. According to our hypothesis, higher housing price will cause larger proportion of two-stage auction, with a view to curbing the rise in future real estate prices through controlling land prices. If the results are consistent with this hypothesis, the reversal causality issue tends to weaken our estimation of the coefficients concerned, rather than create a fake relationship. That is to say, our estimation of both the causes and effects of the land conveyance intervention provides a lower bound of a true relationship. Hence, we lag the independent variables in question by one year to alleviate this possible problem.

Another concern is that the empirical models may omit historical factors in explaining differences in the adoptions of both types. For example, cities with a longer history of land market development may have a larger proportion of English auction. Similar issues may arise when analyzing the determinants of land/housing prices. We use city fixed effects to capture the omitted locational attributes.

Moreover, the error term may not be independently distributed which may cause heteroscedasticity issues. We use the robust estimate of variance, clustered by prefectures, to make sure of consistent standard errors.

3.3.2. Selection bias problems in parcel-level estimation

When discussing the price distortion caused by the two-stage auction, we are concerned that the choice of auction types is related to parcel characteristics—a selection bias issue. One possibility is that for a less competitive parcel, the probability of a successful land sale is higher for two-stage auction than English auction, since the latter requires at least three qualified bidders while the former requires one (see Section 2). Accordingly, less competitive parcels are more likely to adopt two-stage auction. Cai et al. (2013) raise another possibility that local officials will steer “hot” [competitive] parcels towards two-stage auction to maximize their bribery from developers. To deal with this selection bias issue, we use the parcel-level dataset and control for parcel characteristics as far as possible. Moreover, we use two types of identification strategies for the robustness.

One is to use Propensity Score Matching (PSM, henceforth). We can regard the two-stage auction as a treatment, and the control group consists of land parcels using the English auction. The basic idea of PSM is to compare the outcomes of the treated with those of the control parcels that are as similar as possible given observed characteristics, so that the selection bias can be reduced (Imbens, 2014). We will first estimate a Probit model for the choice of auction types. We can then use the predicted values of

Table 2

Descriptive statistics of parcel-level data: 1998–2012.

Variable	Definition	Guapai = 1		Guapai = 0	
		Mean	Std. Dev.	Mean	Std. Dev.
Land price	Parcel conveyance fee (10,000 yuan)	12,832.72	33,419.09	13,734.53	28,092.24
Reserve price	(10,000 yuan)	10,233.17	26,528.78	10,861.02	20,974.34
Land area	(m ²)	45,748.75	80,546.01	40,695.88	61,036.87
Floor area ratio	Ratio of the building's total floor area to the size of the land upon which it is built	2.47	1.59	2.47	1.42
Distance to CBD	Distance to municipal government (km)	30.55	169.62	25.36	74.12
Commercial use	Dummy, = 0 for residential use	0.36	0.48	0.28	0.45
Mixed use	Dummy, = 0 for residential use	0.18	0.38	0.22	0.41
Observations		56,640		13,410	

Data source: land parcel transaction data from Soufun database.

Notes: The auction type dummy, *Guapai*, equals one for two-stage auction, and zero for English auction.

two-stage auction probability, *i.e.* propensity scores, to construct a weight matrix, where the weight is higher when the propensity scores are closer for a pair of controls and treated. Finally, we can estimate the average treatment effect of “two-stage auction” on the treated (ATT)—our parameter of interest—using the following specification:

$$ATT = \frac{1}{n} \sum_{k \in \{Guapai=1\}} \left[\ln Land \ price_k - \sum_{l \in \{Guapai=0\}} w(k, l) \ln Land \ price_l \right] \quad (6)$$

where $w(k, l)$ is the weight of a treated parcel k and a control parcel l . We use one commonly used matching method, *i.e.* Nearest-Neighbor Matching. For each treated unit, this method searches for a control unit with the closest propensity score and makes its weight equals one, while the weights of other controls take the value of zero. Once each treated unit is matched with a control unit the difference between their land prices can be computed using [specification \(6\)](#).

However, PSM is useful when only observed characteristics are believed to affect the choice of land auction types. If there is selection on the unobservables, we can use Treatment-effect model to correct for the bias. We instrument for the endogenous auction type dummy (*Guapai*) with the prefecture-level *Guapai* area ratio (*Guapai ratio*). On one hand, the prefecture -level *Guapai ratio* is positively related to the probability of choosing two-stage auction for the parcel; on the other, the instrument variable is from the prefecture level, thus has little correlation with the parcel price. The equations of the Treatment-effect model are:

Selection model: $Guapai_{ijt}^* = \alpha + \theta \cdot Guapai \ ratio_{jt} + X'_{ijt} \gamma + Z'_{jt} \eta + \delta_t + e_{ijt}$,

$$Guapai_{ijt} = \begin{cases} 1 & \text{if } Guapai_{ijt}^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (7)$$

Outcome model: $\ln Land \ price_{ijt} = \alpha + \lambda \cdot Guapai_{ijt} + X'_{ijt} \gamma + u_j + \delta_t + \varepsilon_{ijt}$.

The corrected average treatment effect can be estimated:

$$ATE = \lambda + \rho \sigma_\varepsilon \left[\frac{\phi_i}{\Phi_i(1-\Phi_i)} \right] \quad (8)$$

where $\Phi_i = \text{Prob}(Guapai_i = 1 | Guapai \ ratio, X', Z')$ and ϕ_i is the standard normal density. ρ measures the correlation between the error terms of the selection and outcome model.

4. Causes of land conveyance intervention

This section will first estimate the effect of housing prices on local officials' land auction type choice. Then exploiting exogenous political events that are associated with more real estate regulation pressure from the central government, we examine the response of local officials in land auction type choice at the parcel level. The third part investigates the impact of career incentives of city leaders on their land conveyance decision.

4.1. Real estate regulation requirement from the central government

Following [Hypothesis 1](#), we first investigate how real estate market situation affects local officials' land conveyance intervention. [Table 3](#) reports the results based on the prefecture-level panel data and fixed-effect model. Column (1) shows a significantly positive relationship between housing prices and *Guapai ratio*. A 1% increase in housing prices is associated with 11% more two-stage auction proportion. This effect diminishes to 5% when we include all controls in Column (2), but still remains significant at the 5% level. Those results are consistent with [Hypothesis 1](#), suggesting that real estate regulation pressure associated with high housing prices leads to a higher degree of government interventions in land conveyance. Column (3) includes an interaction term of *Housing price growth rate* and $\ln(\text{Housing price})$ to further investigate the impact of potential real estate bubbles on land conveyance decision. The results show that in cities with high housing price levels, an increase in price growth rates can cause a more frequent government regulation. Different from the price level variable, housing price growth rate alone has a non-monotonic effect on land conveyance decision: with housing prices being low, an increase in price growth rate has a negative effect on the two-stage auction adoptions; while when housing prices go high, the effect becomes positive. The turning point is at the price of 1886 yuan per square meter, which equals the value of 7th quantile. This implies that the housing price level, instead of its growth rate, is the major focus of the real estate regulation policies of the state and consequently has a strong bearing on local officials' behavior. Local governments take measures in land conveyance to curb real estate price growth only when the housing price is higher than 1886 yuan per square meter. Otherwise, as the housing prices rise faster, they will rely more on the market-oriented English auction to enjoy a higher land revenue.

The impact of fiscal incentives of local governments (emphasized by many previous studies) is also discussed as follows. In Column (2), an increase of the ratio of land revenue to local budgetary revenue (*Land revenue dependence*) significantly decreases the use of *Guapai*. This indicates that if the local finance relies more on land revenue, government intervention in land conveyance will decrease. However, its impact is much weaker than that of the incentives to curb housing prices: according to results in Column (2), one standard deviation increase in *Land revenue dependence* (44.60) generates a 2.50% decrease in two-stage auction proportion; while one standard deviation increase in *Housing price* (1011.68) generates a 34.66% increase. We find no significant

Table 3The effect of housing prices on Ratio of *Guapai* area.

Variables	Fixed Effect Model, dependent variable: <i>Guapai</i> ratio		
	Baseline (1)	All controls (2)	Growth rate of housing prices included (3)
L. Ln(<i>Housing price</i>)	11.12*** (2.080)	5.009** (2.274)	9.755*** (3.149)
L. <i>Housing price growth rate</i>			−38.91*** (12.26)
L. Ln(<i>Housing Price</i>) * L. <i>Housing price growth rate</i>			5.159*** (1.786)
L. <i>Land revenue dependence</i>		−0.056*** (0.0180)	−0.058*** (0.1819)
L. <i>Corruption cases</i>		0.206** (0.0821)	0.142 (0.0875)
L. <i>Illegal land area</i>		−1.437** (0.667)	−0.990 (0.693)
<i>Government intervention</i>		1.079*** (0.2965)	0.715** (0.3593)
L. Ln(<i>GDP per capita</i>)		−2.393 (4.080)	−5.694 (6.340)
L. <i>Secondary industry ratio</i>		−0.186 (0.207)	−0.246 (0.234)
Year2007* L. <i>Secondary industry ratio</i>		0.244*** (0.0715)	0.251*** (0.0856)
<i>Marketization</i>		17.15 (15.14)	17.86 (17.78)
Constant	−0.141 (15.24)	34.03* (20.59)	9.427 (28.13)
Year fixed effect	No	Yes	Yes
City fixed effect	Yes	Yes	Yes
Observations	1504	1169	972
Within group R-squared	0.032	0.163	0.149
Number of cities	285	258	217

Data source: Statistical Yearbook of China, China City Statistical Yearbook, China Land and Resources Statistical Yearbook and annual official reports of People's Procuratorate in 31 provinces.

Notes:

1. The dependent variable is *Guapai* ratio, share of *Guapai* area in total *Guapai* and *Paimai* area (%), used to proxy for government intervention in land conveyance.

2. Definitions of the independent variables and units of measurement: Ln(*Housing Price*), average residential/commercial housing price (yuan/m²) in logarithm; *Housing price growth rate*, %; *Land revenue dependence*, ratio of land revenue to government budgetary revenue (%); *Corruption cases*, provincial corruption cases per 10,000 government officials; *Illegal land area*, provincial illegal land transactions, 10,000,000 m²; *Government intervention*, ratio of budgetary expenditure to GDP, %; Ln(*GDP per capita*), *GDP per capita* (10,000 yuan) in logarithm; *Secondary industry ratio*, share of secondary industry output in GDP, %; *Marketization*, provincial ratio of real estate firms to property sales area, thousand m².

3. The independent variables that might be affected by the land conveyance strategies are lagged by one year to alleviate the reversal causality issue, including Ln(*Housing Price*), *Housing price growth rate*, Ln(*GDP per capita*), *Corruption cases*, *Illegal land area*, *Secondary industry ratio*, *Land revenue dependence*.

4. Standard errors are in parentheses and clustered by prefecture. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

interactive effects between *Land revenue dependence* and Ln(*Housing price*) (which is not reported in Table 3). This suggests that local governments' efforts in controlling land prices caused by the rising housing prices are not affected by their fiscal situations.

We also test Cai et al.'s (2013) argument that *Guapai* adoptions are related to the incentive of corruption. The positive coefficient of *Corruption cases* in Table 3 shows that cities with more occurrences of corruption cases are associated with more *Guapai* adoptions, consistent with Cai et al.'s parcel-based findings. However, this finding is not quite robust: the effect becomes insignificant after controlling for the growth rate of housing price in Column (3).¹³

We conduct sensitivity tests in Table 4 to make sure that the above findings are robust to alternative specifications. (i) As we mentioned earlier, the policy shock in late 2007 caused an increase of industrial parcels using two-stage auction, which cannot be isolated in our sample. Thus we exclude data of the year 2008 in Robust (1). The magnitudes and significances of the effects of housing price and its growth rate are weakened to a small extent, but these do not affect the major findings. (ii) The central government tends to pay close attention on a particular group of cities, particularly those with high housing price level. For example, real estate prices in China's 70 major cities are under strict monitoring and regularly surveyed by the National Bureau of Statistics each month. Robust (2) uses a sub-sample of 70 major cities to check if interventions are more intense in those cities. The magnitudes of the coefficients become much higher, implying those cities respond much more positively to the changes in housing

¹³ To obtain prefecture level corruption proxies, we follow Cai et al. (2011) and use the firm-level surveys conducted in 2004 by the World Bank covering 12,400 firms from 120 cities in China. Following Cai et al. (2011), we use the city averages of firm's Entertainment and Travel Costs (normalized by Total Sales) to proxy for corruption at the prefecture level. As we only have year 2004's prefecture-level corruption proxy, we perceive this as a time-invariant city characteristic and run a random effect for Eq. (1). Results report a significant positive effect of corruption and housing prices on the adoption of *Guapai*, which is consistent with the baseline results. We do not report the results to save space.

Table 4

Results of robustness check.

Variables	Fixed effect		Random effect	
	Ratio of <i>Guapai</i> areas		Ratio of <i>Guapai</i> cases	Ratio of <i>Guapai</i> areas
	Data of 2008 excluded Robust (1)	Subsample of 70 major cities Robust (2)	Robust (3)	Robust (4)
L. Ln(<i>Housing Price</i>)	9.328** (3.727)	13.08 (7.895)	10.23*** (3.104)	5.20** (2.510)
L. <i>Housing price growth rate</i>	−33.38** (13.82)	−73.79** (32.05)	−35.55*** (11.87)	−29.28*** (10.442)
L. Ln(<i>Housing Price</i>) * L. <i>Housing price growth rate</i>	4.270** (1.961)	9.571** (4.459)	4.741*** (1.735)	3.965** (1.572)
All control variables in Column (2) of Table 3 are included.				
Observations	765	292	972	972
Within group R-squared	0.078	0.200	0.155	0.1431
Number of cities	217	64	217	217

Data source: *Statistical Yearbook of China*, *China City Statistical Yearbook*, *China Land and Resources Statistical Yearbook* and annual official reports of People's Procuratorate in 31 provinces.

Notes:

1. The dependent variable is *Guapai ratio*, share of *Guapai* area in total *Guapai* and *Paimai* area (%), used to proxy for government intervention in land conveyance.
2. Definitions and units of measurement: Ln(*Housing Price*), average residential/commercial housing price (yuan/m²) in logarithm; *Housing price growth rate*, %.
3. All control variables in Column (2) of Table 3 are included. In addition, Robust (4) controls the city fixed geographic characteristics, including distance to 14 major cities and region dummies (East China, Middle China and West China).
4. Standard errors are in parentheses and clustered by prefecture. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

prices by intervening more frequently in land conveyance. (iii) We consider another measurement of the dependent variable in Robust (3), the ratio of *Guapai* cases, which might lead to an erosion of accuracy compared with the measurement of *Guapai* areas. The significances of the coefficients are not affected and their magnitudes change a little. (iv) Robust (4) use the random effect model to focus on the effect of the between-group variations in housing prices and its growth rate. We control for a set of important time-invariant city characteristics in the specification, such as distance to major cities and region dummies. The magnitudes of the coefficients become smaller than the results in Table 3, but the major findings still hold.

4.2. Political event study

To provide more direct evidences, we examine the effect of particular political events on land auction type choice using parcel-level data. The events we will consider are the Provincial Communist Party Congress, the State Council Housing price regulation policy and the occurrence of land transaction price with new record highs. These events lead to more intensive real estate regulation pressure from the central government, while other incentives in land conveyance (such as corruption) is dampened, or not affected. If there is a positive effect of the sensitive event on *Guapai* adoption in “hot” cities (in the sense that house price level

Table 5Probit model for political event study: Two-stage auction (*Guapai*), or not.

Variables	2011–2012 (1)	2010–2011 (2)	2010–2013 (3)
Policy dummy stands for	The month of Provincial Communist Party Congress	After Nation #10 implementation (2010/9/30)	1 month after Land king event
Policy dummy * Ln(<i>Housing price</i>) * <i>Housing price growth rate</i>	1.679*** (0.605)	2.863** (1.454)	31.16*** (7.382)
Control variables	Yes	Yes	Yes
Constant	11.79** (4.861)	−4.426 (2.862)	4.016** (1.616)
Observations	21,623	18,983	34,597

Data source: land parcel transaction data from *Soufun* database.

Notes:

1. Table 5 uses the Probit model specified in Eq. (4). The dependent variable equals 1 if the parcel is conveyed using two-stage auction (*Guapai*), 0 if it uses English auction.
2. Control variables include level terms of the interaction term, parcel characteristics (*Reserve price*, *Land area*, *Floor area ratio*, *Distance to CBD*, and dummies for land use patterns (*Commercial use*, *Mixed use*)), city-level GDP per capita, and season, year, city fixed effects. To save space, coefficients of control variables are not reported.
3. Definitions and units of measurement: Ln(*Housing Price*), average residential/commercial housing price (yuan/m²) in logarithm; *Housing price growth rate*, %; *Reserve price*, reserve price of the parcel, 10,000 yuan; *Land area*, area of the parcel, m²; *Floor area ratio*, ratio of the building's total floor area to the size of the land upon which it is built; *Distance to CBD*, Distance to municipal government, km; *Commercial use*, dummy, =0 for residential use; *Mixed use*, dummy, =0 for residential use; Ln(*GDP per capita*), GDP per capita (10,000 yuan) in logarithm.
4. Standard errors are in parentheses and clustered by prefecture. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

and growth rate is high), we can confirm the positive role of price regulation requirement from the central government in land intervention.

The first event we consider is the convening of Party Congress. China's Communist Party Congress is held every five years, and there is variation of the timing of the Provincial Communist Party Congress. Decisions of the reappointment or promotion of local cadres are made after the convening of the congress. Moreover, during this period the performance of cadres usually endures intensive media exposure. As a result, the government has a strong incentive to maintain social stability during the meetings (Nie, Jiang, & Wang, 2013). As the overheated real estate market has become a major social concern since 2003, it is extremely important to keep the land market stable during this period. For the same reason, the incentive of corruption is dampened. In this way, we can attribute the temporary rise of *Guapai* adoption in cities with higher housing price and faster growth rate to the effect of price regulation incentive, rather than corruption.

Due to the limited availability of data, we focus on the Provincial Communist Party Congress convening in 2011 and 2012. We use land transactions in 2011 and 2012 to identify the short-term effect of the event. Column (1) in Table 5 reports the results. The policy dummy equals 1 in the provincial congress month, and 0 otherwise. The probability of adopting *Guapai* for “hot” cities significantly increases in the congress month, indicating that these local officials intervene more frequently in land transactions to prevent fluctuations in auction price during the sensitive period. We further substitute the Policy dummy for a series of indicator variables which equals 1 for each of the month before and after the convening of the Provincial Communist Party Congress.¹⁴ Results indicate that there is a temporary increase of land intervention after the event. The effect lasts for no more than 3 months and then reduces to zero.

The second event we use for identification is the implementation of a nationwide real estate regulation policy. Fueled by a vast increase in the credit since late 2008 due to the financial crisis stimulus package, the house and land market have started a new round of price surge since mid-2009. In response, the central government had implemented “the most stringent policy” to curb rising property prices. The State Council of China issued a document named “curbing excessive growth in property prices in some cities” in 2010 (known as the Nation #10 policy). On Sep. 30, 2010, Ministry of Housing and Urban-Rural Development, Ministry of Land Resources and Ministry of Supervision, issued a more detailed document named “further implementing Nation #10”. The provisions emphasize that local officials, who fail to take necessary measures to stabilize the real estate market, will be interviewed or penalized by the cadres of the higher rank. We perceive the issuing of these enforcement provisions as a start of a sensitive political event. If the price regulation pressure caused by the policy affects local officials' choice of land auction type, we should expect the parcel is more likely to be auctioned using *Guapai* in “hot” cities.

Column (2) of Table 5 uses a sub-sample of land transactions in 2010 and 2011 to identify the short-term effect of this policy. The policy dummy equals 1 after Nation #10's implementation, and 0 otherwise. On average, there was a significant increase of *Guapai* probability for parcels in “hot” cities after Nation #10's implementation. This suggests that local officials positively respond to the price regulation requirement from the central in land auction. We also test the time effect of the policy.¹⁵ For parcels conveyed after the policy, we create a series of month dummies and interact them with *Housing price* and *Housing price growth rate*. Results show that the effect of the policy seems short-term, with a positive effect on land intervention in “hot” cities lasting for 2 months since Nation #10's implementation. The effect gradually reduces to zero for about 6 months.

The third event is the occurrence of land auction price with new record highs. Since China's establishment of urban land leasehold market in 2002, land auctions in “hot” cities have always been the focus of the media. During the real estate boom, the occurrence of land auction price with new record highs (usually known as “king of the land” in the press) can cause tremendous social discontent which soon brings in great pressure from the central government.¹⁶ Consequently, we conjecture that the occurrence of “land king” case in “hot” cities will be followed by more intensive land intervention, which means that the likelihood of adopting *Guapai* will increase.

Due to the limited availability of data, we focus on the new round of real estate regulation since 2010 and use land transactions since 2010 to identify the effect of the “land king” event. We manually collect the “land king” events using Google. The reported events during 2010–2012 amount to 35, involving 20 cities. Column (3) in Table 5 reports the results of the regression. The policy dummy equals 1 for parcel transacted 1 month after the “land king” occurrence for the particular city, and 0 otherwise. Results show that compared to cities without the occurrence of “land king”, the probability of adopting *Guapai* greatly increases in “hot” cities 1 month after the event. Then we estimate the time effect of the event.¹⁷ For parcels conveyed after the event in the particular city, we create a series of month dummies and interact them with *Housing price* and *Housing price growth rate*. We document a sudden decrease of *Guapai* adoption in the “land king” month. It is possible that during this period the pressure from the central government has not arrived and local governments tend to rely more on English auction to maximize land revenue in a booming period. One month later, the adverse effect of the event starts to appear. There is a significant increase of land intervention likelihood that lasts for about 3 months. This is consistent with our conjecture that pressure from the central government leads to more land intervention.

¹⁴ To save space, results of the time effect of the event are not reported.

¹⁵ To save space, results of the time effect of the event are not reported.

¹⁶ Ministry of Land and Resources has issued several official documents, which require each “land king” case to be surveyed by the central government (See Ministry of Land and Resources document [2010] #34 and #204). During this period, provincial governments, such as Fujian and Hunan, have stated that local officials will be interviewed or even penalized if more than one parcels are auctioned with a record-high price in the jurisdiction.

¹⁷ To save space, results of the time effect of the event are not reported.

Table 6

The effect of local officials' career incentive on land conveyance strategy.

Variables	(1) all sample	(2) data of 2008 excluded
L. Ln(<i>Housing Price</i>)	2.963 (2.562)	−1.210 (2.968)
<i>Year in Office</i>	−6.448 (4.785)	−14.46** (6.749)
L. Ln(<i>Housing Price</i>)* <i>Year in Office</i>	0.877 (0.633)	2.021** (0.906)
All control variables in Column (2) of Table 3 are included.		
Observations	1169	923
Within group R-squared	0.1646	0.099
Number of cities	258	258

Data source: *Statistical Yearbook of China*, *China City Statistical Yearbook*, *China Land and Resources Statistical Yearbook* and annual official reports of People's Procuratorate in 31 provinces. Information of the party secretaries of all prefecture-level cities in China is collected from baike.baidu.com.

Notes:

1. Definitions and units of measurement: Ln(*Housing Price*), average residential/commercial housing price (yuan/m²) in logarithm; *Housing price growth rate*, %; *Year in Office*, city Party secretary's total years in office.
2. All control variables in Column (2), Table 3 are included.
3. Standard errors are in parentheses and clustered by prefecture. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Overall, the above findings suggest that the probability to get intervened for an auctioned parcel sharply increases during the sensitive political event, and then quickly returns to normal after the events. This pattern reflects the misaligned incentives of Chinese (central and local) governments and the changing incentive structure of local officials in land conveyance. During the sensitive periods, the cost of rising land price far exceeded its benefit for local officials, resulting in more interventions in land conveyance. This interventionism was weakened to a large extent as the impact of these events faded out.

4.3. Role of local officials' career incentive

We continue to examine the impact of career incentives of city leaders on their land conveyance decisions. Results are reported in Table 6. Following the existing literature, we use the city Party secretary's number of years in current position (*Year in Office*) to proxy for city leaders' career incentives. To rule out the possibility that personal characteristic differences across tenures may affect the land conveyance behavior, we exploit variations in housing prices as an additional difference to identify the effect of career incentives. An interaction term of Ln(*Housing Price*) and *Year in Office* is included in the specification of Eq. (1). Table 6 shows that in cities with high housing prices, an increase of years in office for the city Party secretary generates a positive effect on the adoption of two-stage auction. This implies that city leaders at the start of their political careers tend to focus more on the land revenue maximization, responding less positively to the social welfare considerations as a result of rising housing prices. However, the coefficient of the interaction term in Column (1) is not statistically significant. It is possible that data in the year 2008 cause an anomaly. We exclude 2008's data in Column (2) and find a larger positive interactive effect of *Year in Office*, significant at the 5% level. The results are consistent with those from the literature on political cycle. This well confirms that Chinese local officials tend to accelerate investment at the start of their term to enhance their promotion likelihood, which highly depends on the economic performance in the jurisdiction.¹⁸ This is consistent with Hypothesis 2 in that the relative benefit for local officials from the rising land prices rises as their promotion probabilities are higher. To some extent, these results also indicate that the career incentives of local officials can limit the effect of the national regulation policy, so that the distortion of land allocation can be circumvented.

5. Effects of land conveyance intervention

This section will first check if there is a significant price distortion between two-stage auction and English auction, then examine the effect of land conveyance intervention on local housing markets.

5.1. The existence of price distortion

The hypothesized intention of land conveyance intervention is to regulate the rising land prices. Therefore we should first verify the existence of price distortion between two-stage auction and English auction. Table 7 compares the statistical characteristics of land price using the two auction types. Using the prefecture-level land conveyance data, *t*-test in the first row suggests a significant underpricing of two-stage auction compared with English auction. The price difference amounts to 524.14 yuan per

¹⁸ Existing studies find a non-linear effect of the tenures of city leaders on government investment, such as Guo (2009), Kung and Chen (2013). City leaders will increase government spending on investment in the 3rd or 4th year of their tenures, since those are the crucial time points for their performance-based political promotion (Guo, 2009). This paper finds no significant non-linear effect of year in office on land conveyance behavior (which is not reported in Table 6). This is reasonable that city leaders are incentivized to collect more land revenues at the start of their terms, in order to increase government spending in subsequent years.

Table 7Price differences for *Paimai* and *Guapai*.

Variable	Data	Land conveyance using <i>Paimai</i>		Land conveyance using <i>Guapai</i>		Difference (<i>Paimai</i> – <i>Guapai</i>)	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Land price (yuan/m ²)	Prefecture-level (2003–2008)	1022.65	1698.93	513.31	579.87	524.14***	39.49
Land price (yuan/m ²)	Parcel-level (1998–2013)	4263.04	66.12	3814.31	293.09	448.72***	603.34

Data source: land parcel transaction data from *Soufun* database.Notes: The “Difference” column displays results of *t*-test for the price differences of *Paimai* and *Guapai*. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

square meter, almost half the price for English auction. We also calculate the price difference using the parcel-level dataset, with a longer time span. The absolute value, 448.72 yuan per square meter, is quite close to that calculated using prefecture-level data. Yet, the calculated difference accounts for only 10% of the price for English auction. Although the extent of price distortion displays somewhat dis-similar (using the two different datasets), the descriptive statistics suggest a significant price distortion, which is likely caused by the two-stage auction. We will perform rigorous regressions to estimate the magnitude of that distortion in the following part.

As discussed in Section 3, the choice of auction types can be related to parcel characteristics, generating a selection bias problem. We exploit a comprehensive parcel-level dataset to deal with this problem. Table 8 displays the empirical results. OLS estimation is conducted in Columns (1) and (2). With city and year fixed effects controlled, Column (1) shows that prices are significantly lower for two-stage auction than for English auction by 36%. Based on the specification (Eq. (5)) in Section 3, Column (2) controls parcel characteristics to alleviate selection bias. The price difference for the two auction types reduce to 13.9%, suggesting that less competitive parcels are auctioned using *Guapai*, which generates a negative selection bias. As discussed in Section 3, this occurs because for a less competitive parcel, the probability of sale is higher using two-stage auction. Results of a Probit estimation in Column (3) verify this possibility. Coefficients on parcel characteristics suggest that less competitive parcels (such as lower *Reserve price* and larger *Land area*) tend to have a higher possibility to be auctioned using *Guapai*.

Table 8

The existence of price distortion.

Variables	OLS:1998–2013		Probit:1998–2013	Treatment effect: 2003–2008	
	(1) Ln(Land price)	(2) Ln(Land price)	(3) <i>Guapai</i>	(4) <i>Guapai</i>	(5) Ln(Land price)
<i>Guapai</i>	−0.360*** (0.128)	−0.139*** (0.0146)			−0.170*** (0.0470)
Ln(<i>Reserve price</i>)		0.993*** (0.00541)	−0.182*** (0.0403)	−0.220*** (0.0733)	0.968*** (0.00820)
Ln(<i>Land area</i>)		−0.0102* (0.00563)	0.234*** (0.0398)	0.181** (0.0769)	0.0150 (0.00946)
<i>Floor area ratio</i>		0.00388** (0.00167)	0.0463** (0.0193)	0.0561 (0.0353)	0.00965*** (0.00270)
Ln(<i>Distance</i>)		−0.00670** (0.00276)	0.00501 (0.0466)	0.0222 (0.131)	−0.0124** (0.00624)
<i>Commercial use</i>		−0.0371*** (0.00689)	0.354*** (0.0677)	0.526*** (0.0992)	−0.0608*** (0.0146)
<i>Mixed use</i>		0.0159*** (0.00591)	−0.00994 (0.0621)	0.0480 (0.0995)	0.0232* (0.0133)
<i>Guapai ratio</i>				0.0153*** (0.00549)	
Constant	8.222*** (0.163)	0.498*** (0.0341)	4.404*** (0.298)	−0.303 (3.098)	0.430*** (0.0514)
Season effect	No	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
City fixed effect	Yes	Yes	Yes	No	Yes
Observations	70,050	54,027	58,114	9107	9107
R-squared	0.208	0.973			
ρ					−0.0633 (0.0354)

Data source: land parcel transaction data from *Soufun* database.

Notes:

1. Definitions and units of measurement: Ln(*Land price*), parcel conveyance fee, 10,000 yuan; *Guapai*, = 1 if the parcel is conveyed using two-stage auction (*Guapai*); *Reserve price*, reserve price of the parcel, 10,000 yuan; *Land area*, area of the parcel, m²; *Floor area ratio*, ratio of the building's total floor area to the size of the land upon which it is built; *Distance to CBD*, Distance to municipal government, km; *Commercial use*, dummy, = 0 for residential use; *Mixed use*, dummy, = 0 for residential use; Ln(*GDP per capita*), *GDP per capita* (10,000 yuan) in logarithm. ρ , correlation between error terms of the selection and outcome model in Eq. (8).

2. Standard errors are in parentheses and clustered by prefecture. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Table 9

Price distortion using PSM (Nearest Neighbor Matching).

Variables	Sample	Treated	Controls	Difference	S.E.	T-stat
Ln(Land Price)	ATT (1)	8.1892	8.3712	−0.1820*	0.1140	−1.60
	ATT (2)	8.1531	8.3526	−0.1995***	0.0301	−6.63

Data source: land parcel transaction data from *Soufun* database.

Notes:

1. We use the Nearest Neighbor Matching method, where the treated are *Guapai* parcels and controls are *Paimai* parcels. The Propensity Score estimation in first row includes all the control variables in Column (3) of Table 8, yet the treated and controls are not balanced given the observed parcel characteristics due to too many restriction conditions. Thus instead of including city and year fixed effects, we include in the second row the prefecture-level attributes, such as *GDP per capita*, *Housing price* and *Tertiary industry ratio*. The balancing requirement is satisfied in this specification. To save space, results of the Propensity Score estimation are not reported.

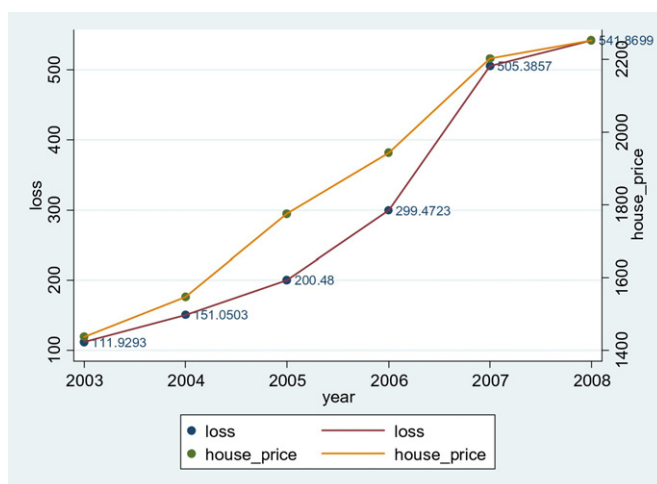
2. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Table 9 presents the results of PSM. According to Section 3, PSM is useful to correct for the selection bias when the observed characteristics are believed to affect the choice of auction types. We calculate the average treatment effect of *Guapai* on the treated (ATT) based on specification (6). The corrected price differences between the two types are displayed in the “Difference” column in Table 9. The Propensity Score estimation in the first row includes all variables in Column (3), Table 8. Since this specification has too many restriction conditions, the treated and controls are not balanced, making the standard errors quite large. We then replace city and year dummies with several prefecture-level attributes, such as *GDP per capita*, *Housing price* and *Tertiary industry ratio*. The balancing requirement is satisfied in the new specification. The second row of Table 9 presents the results. The corrected price difference is significant at the 1% level, slightly different from the estimation in the first row. The estimated magnitude of price distortion is larger than OLS results in Column (2), Table 8: land price for two-stage auction is lower than for English auction by 19.95%.

To deal with the possible selection on unobservables, we apply the Treatment-effect model, with the prefecture-level *Guapai* ratio being the instrument for the endogenous auction type dummy (*Guappai*). Since we only have the *Guapai* ratio data of 2003–2008, the sample size greatly shrinks, from 70,050 to 9107. Columns (4) and (5) of Table 8 display the estimation results of Eq. (7) and (8). The estimated price difference is 17%, significant at the 1% level. The parameter ρ is less than zero, suggesting a negative correlation between error terms of the selection and outcome model. However, ρ is not statistically significant. Therefore we can conclude that the selection bias of auction types is largely caused by selection on observables.

Taken together, these findings show a consistently significant price distortion of two-stage auctions: parcel prices are 14%–19% lower than those using English auction after correcting for selection bias. A similar study by Cai et al. (2013) also finds such a price distortion. However, it is interesting to note that, their study of 15 Chinese cities estimates a much higher price distortion, which is about 70%. Moreover, they find a significant positive selection on unobservables using Heckman MLE, which they believe is the evidence of corruption, that is, local officials are steering “hot” [competitive] parcels towards two-stage auction to maximize their bribery from developers. Our study using nation-wide land parcel transactions shows an insignificant correlation of the selection on unobservables, a somewhat different result.

Based on the estimated price distortion caused by two-stage auction and the aggregate land revenue at the prefecture level, we perform a back-of-the-envelope calculation of the implicit fiscal loss generated by the adoption of two-stage auction. We use the estimated price distortion of the treatment effect model (Column (5), Table 8) in order to compare the estimated revenue loss caused by *Guapai* with the prefecture-level land conveyance revenue in the same period (land conveyance revenues for

**Fig. 7.** Land revenue loss (million yuan) and Housing prices (yuan/m²).

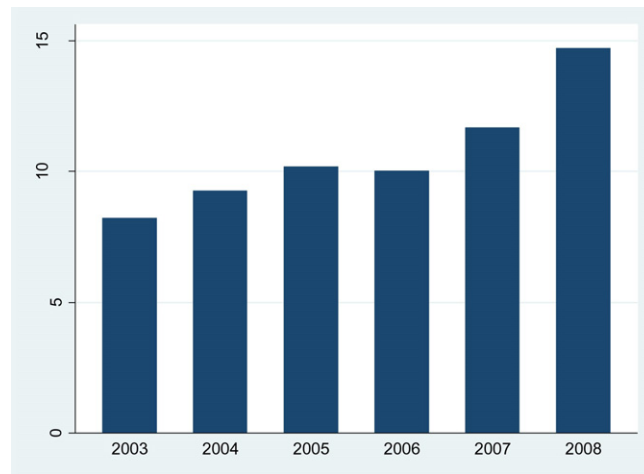


Fig. 8. Percentage of revenue loss in total land revenue.

Guapai are only available during 2003–2008). Results in Column (5), Table 8 shows that the estimated average price distortion caused by *Guapai* during 2003–2008 is 17%. Given the magnitude of the distortion, we can calculate the resulting loss of land revenue by year. The revenue loss equals $(0.17 \times \text{actual land revenue for } Guapai) / 0.83$. It is calculated at the prefecture-level. The results imply that local officials sacrifice an average of 112 million yuan by adopting two-stage auction in 2003 (see Fig. 7). That is to say, if all land parcels are auctioned by English auction, local governments can enjoy 83 million yuan more in terms of land revenues. This amount on average accounts for 8% of the city's total revenue from land conveyance in 2003 alone. As shown in Fig. 7, the estimated fiscal loss has been increasing since 2003, as housing prices have increased rapidly. Fig. 8 further shows that the percentage of the loss in total land revenue is also increasing over the years.

5.2. Effects on housing market

We have presented evidence that the manipulated two-stage auction (*Guapai*) leads to a distorted land auction outcome. Next question is that, will the depressed land price result in lower housing prices? This part will investigate the effect of land conveyance intervention on housing prices.

Theoretically, there are two possible channels of the effect of land price on housing price: one is the channel of price signal in the incomplete market (Chau, Wong, Yiu, Tse, & Pretorius, 2010), contending that a high land auction price sends a positive signal, which immediately affects home-buyers' expectation and drives housing prices upwards. If this channel exists, land intervention will show effect on housing prices in a short time. The other possible channel is related to the cost-oriented pricing. In a monopolistic competition market, excess profit of real estate industry approaches zero. In this case, the regulated land prices may also decrease house prices by reducing the cost of real estate development. Due to the existence of construction lag, it will take a longer time for this channel to take effect.

Table 10 reports the results based on Eq. (3). We estimate a two-stage system GMM model using both the lagged differences and lagged levels of the endogenous variables as instruments. The estimated regulation effect seems large: a one standard deviation (22.97) increase of two-stage auction proportion is associated with a 13% lower housing price at the prefecture level. The lagged *Guapai* ratios do not exert a significant impact on the current housing prices. Those results indicate the existence of the price signal channel, which means in an incomplete market, much of the attention should be put on managing house-buyers' expectations in regulating real estate market.¹⁹ It should be noted that the results are not robust to the choice of GMM instruments. The effect of *Guapai ratio* is insignificant in some specifications (but consistently negative). Because we cannot obtain the exact real estate transaction information that build on the typical land parcel, results in Table 10 should be considered suggestive.

6. Conclusion

Since China's real estate market boom in 2003, the skyrocketing housing prices as well as land prices have become a major social concern and thus an urgent political concern for the central government. This paper investigates how the real estate regulation policy diverts the behavior of local governments in land leasehold conveyance. By means of an accountability system, the central government create incentives for local officials to respond to this policy. We present evidences that such a political concern leads to government intervention in land transactions which in turn depresses land prices.

¹⁹ This explains the reason why regulation policies tend to avoid the signal effect of rising land prices even at the expense of decreasing land supply. For example, Nation #8 issued by the State Council in 2005 states that "for localities where the growth rate of housing prices exceeds that of CPI, the approval process of construction land supply will be suspended".

Table 10The effect of land intervention on housing market: $\ln(\text{Housing price})$.

Variables	SYS-GMM
L. $\ln(\text{Housing price})$	0.486*** (0.130)
<i>Guapai ratio</i>	−0.00576** (0.00224)
L. <i>Guapai ratio</i>	0.000560 (0.00173)
<i>Land supply area</i>	0.000186 (0.000137)
L. <i>Land supply area</i>	−0.000215 (0.000227)
<i>GDP per capita</i>	0.196*** (0.0743)
L. <i>GDP per capita</i>	0.0342 (0.0345)
Constant	4.281*** (0.976)
Year fixed effect	Yes
Observations	1190
Number of cities	1190
AR(2)	0.4404
Sargan	0.9703

Data source: *Statistical Yearbook of China, China Land and Resources Statistical Yearbook*.

Notes:

1. We use system GMM method developed by Arellano and Bover (1995) and adopt the two-step-corrected-robust estimators as suggested by Windmeijer (2005).

2. Definitions and units of measurement: $\ln(\text{Housing Price})$, Average residential/commercial housing price (yuan/m²) in logarithm; *Guapai ratio*, share of *Guapai* area in total *Guapai* and *Paimai* area, %, used to proxy for government intervention in land conveyance; *Land supply area*, residential and commercial land supply area (10,000 m²); $\ln(\text{GDP per capita})$, *GDP per capita* (10,000 yuan) in logarithm.

3. The endogenous variables are *Guapai ratio*, *Land supply area* and *GDP per capita*, while the year dummies are regarded as strictly exogenous variables. With the existence of construction time lag, we consider one period of lag for the endogenous variables, assuming land intervention may take effect in one year.

4. We report *p*-value for AR (2) and Sargan test in the last two rows. There is no second order serial correlation in the first-differenced errors, and the overidentifying moment conditions are valid.

5. Robust standard errors are in parentheses. * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Using the proportion of two-stage auction vs English auction as the measurement of government intervention in land conveyance, we have exploited variations in real estate market situations to investigate how political considerations affect land conveyance decisions. Based on a prefecture-level dataset, evidence suggests that two-stage auctions are adopted more frequently than English auctions when a city is experiencing a housing market boom (with higher housing prices). We then use parcel-level data and find that during particular sensitive political events, cities with higher house price and faster growth rate tend to adopt two-stage auction more frequently. These findings point to a positive prefecture-level response to the real estate regulation policy, leading to more intervention in land auction. However, this effect is dampened when city leader is more incentivized to get promoted. This means that the misaligned incentives of Chinese governments limit the effect of a national regulation policy, so that the distortion of land allocation caused by administrative regulation can be circumvented to some extent. Finally, government intervention in the two-stage auction are proved to exert negative effects on land prices and housing prices (using a comprehensive parcel-level dataset and the prefecture-level dataset). It is estimated that local governments lose 8%–15% of their total land revenue in the attempt to depress land prices.

Both researchers and observers have long emphasized the land revenue maximization incentives in China's land allocation. Yet few of them have explained the existing government intervention regime in the land auction process. Among the limited literature, some researchers emphasize that the incentives of underpricing industrial land parcels are to attract outside investment (Tao et al., 2010). Others contend government manipulation as evidence of corruption (Cai et al., 2013). In this sense, our new findings add to the existing knowledge of government behavior having regard to political impacts on land conveyance decision.

This paper reveals that the intention of land intervention is associated with improving public welfare after all. However, this practice has a couple of important risks.²⁰ First, such intervention would not come at no cost. At least, this has already undermined a possibly efficient market mechanism (Peng & Thibodeau, 2012). Particularly, it does not solve the mismatches between housing supply and demand and can cause a distortion of land allocation. Second, there is a problem of little or no transparency in the eyes of the public during the course of land conveyance. Worse still, corruptions are susceptible (Cai et al., 2013).

Therefore, our policy recommendation is that governments should try to avoid price fixing and stop unnecessary intervention in land transactions. More essentially, these short-run price regulation measures originate from the misaligned incentives of

²⁰ The net impact on social welfare of government intervention in land auction requires a general equilibrium framework and more comprehensive data, which is a topic worth investigating in the follow-up analysis.

Chinese governments. Therefore within the current institutional framework, central government should design an appropriate institution that aligns incentives of political officials, market efficiency and public welfare. Recently there have been discussions on how to shift away from the GDP-oriented cadre evaluation system to a public-welfare-oriented one. In the case of the real estate market, the central government should consider how to drive the efforts of local governments to build a well-functioned affordable housing system while maintain an efficient and fair land market.

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